ORIGINAL


RECEIVED

2010 SEP -8 P 2:46

AZ CORP COMMISSION
DOCKET CONTROL

UniSourceEnergy SERVICES

P.O. Box 711
Tucson, Arizona 85702

September 8, 2010

Docket Control
Arizona Corporation Commission
1200 West Washington Street
Phoenix, AZ 85007

Re: Docket No. E-00000D-09-0020

UNS Electric, Inc. ("UNS Electric") hereby files its *revised* Reliability Must-Run ("RMR") study for Santa Cruz County. This RMR study was filed with Arizona Corporation Commission Staff, electronically, on August 13, 2010.

If you have any questions, please contact me at (520) 884-3680.

Sincerely,

Jessica Bryne

Jessica Bryne

cc: Prem Bahl, ACC
Melody Gilkey, UES

Arizona Corporation Commission
DOCKETED

SEP 8 2010

DOCKETED BY

# SANTA CRUZ COUNTY

## A STUDY OF SIMULTANEOUS IMPORT LIMIT, RELIABILITY MUST-RUN GENERATION, MAXIMUM LOAD SERVING CAPABILITY FOR YEARS 2010, 2013 AND 2019

Prepared for:
Arizona Corporation Commission
Utilities Division
1200 West Washington St.
Phoenix, Arizona 85007

January 2010
Revised August 2010

## Results

The following table represents the findings discussed in the balance of this report:

**Table 1: Load Serving Analysis for Santa Cruz County (N-1 analysis)**

| Year | Santa Cruz Forecasted Peak | Study System Load[1] | Metric | Metric Value | Limiting Element | Limiting Outage | RMR & MLSC Generation | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Station | Dispatch/Production Cost |
| 2010 | 85 MW | 49 MW | SIL | 51 MW | Valencia 115 kV bus ΔV | Del Bac – Nogales 115 kV line | None | 0 MW |
| | | 130 MW | MLSC | 130 MW | Nogales 115 kV bus ΔV | Del Bac – Nogales 115 kV line | Valencia CT1, 2, 3, 4 | 62 MW |
| | | 85 MW | RMR | 24 MW | Valencia 115 kV bus ΔV and limit of 65 MW at WAPA Nogales 69 kV bus | Del Bac – Nogales 115 kV line | Valencia CT1 @ 10MW, CT4 @ 14 MW[2] | 24 MW/$550 k |
| 2013 | 95 MW | 120 MW | SIL | 127 MW | Nogales-Kantor 138 kV line overload | N-0 | None | 0 MW |
| | | 190 MW | MLSC | 190 MW | Nogales-Kantor 138 kV line overload | N-0 | Valencia CT1, 2, 3, 4 | 62 MW |
| | | 100 MW(1) | RMR | 0 MW | n/a | n/a | None | 0 MW |
| 2019 | 112 MW | 120 MW | SIL | 127 MW | Nogales-Kantor 138 kV line overload | N-0 | None | 0 MW |
| | | 190 MW | MLSC | 190 MW | Nogales-Kantor 138 kV line overload | N-0 | Valencia CT1, 2, 3, 4 | 62 MW |
| | | 117 MW[1] | RMR | 0 MW | n/a | n/a | None | 0 MW |

[1] SIL and MLSC Study System Loads include a 5% load margin used in determining voltage stability issues

[2] Combination of generation based on CT1 minimum and CT4 part load capability.

## Introduction

UNS Electric, Inc. ("UNS Electric") serves Santa Cruz County with a radial system interconnected to the Western Area Power Administration ("WAPA") 115 kV transmission system (see Exhibit 1 on the following page). From the interconnection point at WAPA's Nogales Tap substation near Tucson, the UNS Electric 115 kV system proceeds down to the Kantor substation. From the Kantor substation, the system moves in order from the Canez substation to the Sonoita substation to the Valencia substation.

Approximately 52% of UNS Electric's Santa Cruz load is located at the Valencia substation and another 30% at the Sonoita substation. Hence, 82% of the total load is located on the last 8.5 miles of the system. In addition to the 8.5 mile section just mentioned, lengthy 115 kV ties are also being used to connect the Saguaro and Apache generating stations to the Nogales Tap station. Because the bulk of the UNS Electric Santa Cruz load is being serviced in this manner, low voltage becomes an issue at higher loads.

Presently, the low voltage issues are mitigated by dispatching local gas turbine generators at the Valencia substation during peak load periods. These turbines supply some power locally, which helps reduce loading on the 115 kV network. They also enhance voltage support by contributing a modest amount of reactive power ("VAR"s). The gas turbines are acting as Reliability Must-Run ("RMR") generation by supporting the system this way. The purpose of this study is to quantify the effectiveness of the turbines in supplying RMR generation.

Though local generation is being used now, UNS Electric is planning to upgrade the 115 kV radial line for operation at 138 kV, served from Tucson Electric Power Company's ("TEP") 345/138 kV transformer at its Vail substation (see Exhibit 2 on page 4). This work is scheduled for completion by 2012. The 2013 and 2019 representations in this RMR study assume that the 138 kV upgrade work is complete.

**Exhibit 1: UNSE-Santa Cruz 115 kV System (2010-2012)**

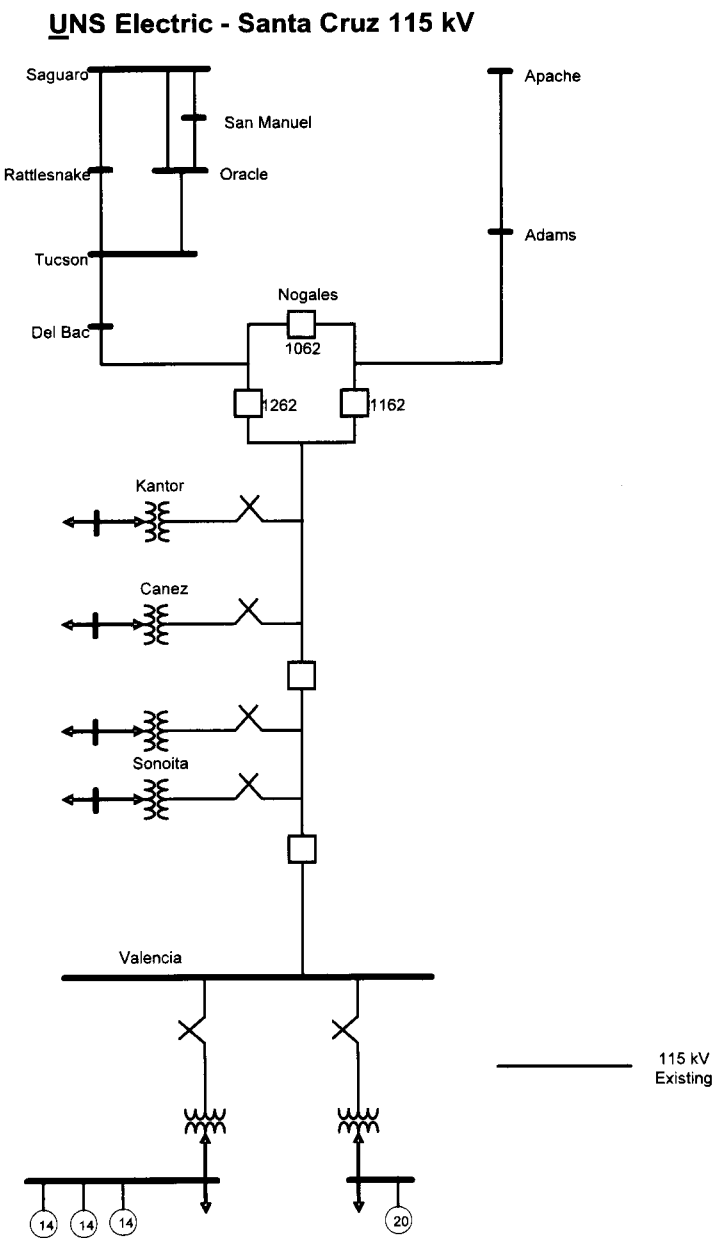
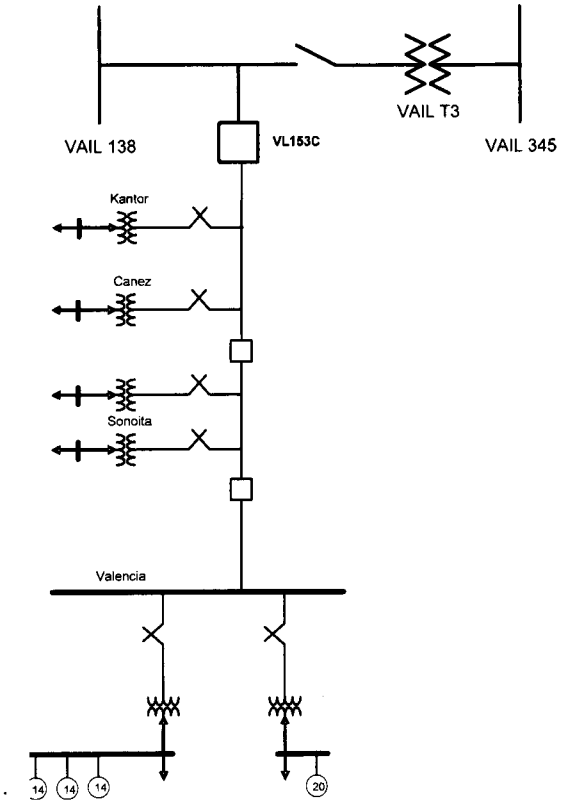


**Exhibit 2: UNSE-Santa Cruz Proposed 138 kV System (2013 and beyond)**

**UNS Electric - Santa Cruz 138 kV**



## Study Assumptions

The existing Santa Cruz UNS Electric system was explicitly modeled within the 2010, 2013 and 2019 Arizona coordinated heavy summer cases prepared by the Southeast Arizona Transmission Study ("SATS") group. The cases were revised to include detailed representations of TEP's 138 kV system and UNS Electric's 115 kV transmission radial line in Santa Cruz County. The 115 kV to 138 kV conversion is detailed in the 2013 and 2019 cases.

A new substation was planned for installation between the Kantor and Canez substations in the 2008 RMR Report (the "Tubac substation"); it is no longer under consideration.

Also, there are plans in-place to maintain unity power factor on-peak at UNS Electric's 13.2 kV load buses in Santa Cruz County. In the 2008 RMR Report unity power factor was assumed. Actual power factor data, that is representative of UNS Electric's power factor improvement program, was used to determine loads that are modeled in this study.

UNS Electric's Santa Cruz system load was assumed to be distributed among the substations in the following manner:

| Substation | Percentage of total |
|---|---|
| Kantor | 9.0% |
| Canez | 9.0% |
| Sonoita | 30% |
| Valencia | 52% |

The Valencia gas turbines were modeled based on the following characteristics:

| | Power Output | | Reactive Output | |
|---|---|---|---|---|
| Turbine | Maximum | Minimum | Maximum | Minimum |
| Valencia turbine #1 (1) | 14 MW | 10 MW | 8 MVAR | -5 MVAR |
| Valencia turbine #2 (1) | 14 MW | 10 MW | 8 MVAR | -5 MVAR |
| Valencia turbine #3 (1) | 14 MW | 10 MW | 8 MVAR | -5 MVAR |
| Valencia turbine #4 (2) | 20.0 MW | 10 MW | 15 MVAR | -25 MVAR |

(1) Based on compliance reports
(2) Based on nameplate

The forecasted peak demand for the three study years is:

| Santa Cruz UNS Electric Peak Demand[1] | |
|---|---|
| Year | Demand |
| 2010 | 85 MW |
| 2013 | 95 MW |
| 2019 | 112 MW |

[1]UNS Electric prepared by TEP Forecasting Group 02/02/09

The UNS Electric Santa Cruz County electric system was modeled with two basic configurations:

- The existing 115 kV radial line served from WAPA's Nogales Tap substation (2010); and
- The planned 138 kV radial line served from TEP's Vail substation (2013, 2019).

N-1 contingencies on surrounding systems were considered for these cases since the system might be prone to voltage perturbations for disturbances on the WAPA/SWTC system. SIL was previously determined based on N-0 (NERC/WECC Category A). The methodology was changed for the 2010 RMR study to be consistent with TEP and UNS Electric planning practices that consider N-1 (NERC/WECC Category B) contingencies.

It should also be noted that, through 2011, WAPA's worst case NERC/WECC Category C contingency on its system – a breaker failure on the 1062 breaker at the Nogales Tap substation – will isolate the UNS Electric Santa Cruz system. The same holds true beyond 2012 for a loss of TEP's Vail T3. Also, any contingency involving the UNS Electric transmission radial will result in at least partial loss of load; however, load restoration plans are in place. UNS Electric has made substantial improvements to operating procedures. The Company has also invested in facilities to improve reliability and reduce outage restoration time. For results, refer to Table 1 on page 1. The Outage Restoration Plan was updated to include the following improvements:

- Integrated operational control of the facilities with those at the TEP operating center;
- Use of both TEP and UNS Electric field personnel for outage response;
- Analysis and implementation of procedures to improve restoration times for transmission outages (e.g., interconnecting radio systems, cross-training employees, especially those in dispatching, field operations or field crews);
- A comprehensive vegetative management program that includes biannual patrols by air to eliminate events caused by vegetation contact with lines; and
- Completion of GIS data conversion to Smallworld software and integration with STORMS software, and OMS software.

Facility investments include:

- Construction and operation of new shunt capacitors dispersed among feeders served by each of the UNS Electric substations;
- Addition of black start capability at the Valencia generating station, in service by 2010;
- Remote control startup of the Valencia generating units and synchronization with the transmission system;
- Completion of a 46 kV emergency tie line of approximately 20 MW capacity between the TEP Canoa substation and the UNS Electric Kantor substation;

- Remote restorative switching capability to serve Kantor and Canez substations from Canoa, and remote switching for service restoration to the Sonoita and Valencia substations via the Valencia generators; and
- Replacement of wood structures with steel poles to improve reliability of the existing 115 kV line.

**Simultaneous Import Limit**

For N-1 contingencies the SIL was calculated to be 51 MW (load at SIL = 49 MW) for the 2010 case. At this import there is a voltage drop exceeding 5% at the Valencia 115 kV bus for loss of the Del Bac-Nogales 115 kV line. Post-contingency delta-V > 5% at any load serving bus is reason to reduce the SIL. As the forecast load of 85 MW exceeds the load at SIL there is an RMR condition in 2010.

In 2013 the SIL increases to 127 MW (load @ SIL = 120 MW) due to the increased transfer capability at 138 kV and the improved voltage regulation afforded by the stiffer source served directly from TEP's Extra High Voltage ("EHV") system via a 345/138 kV transformer, Vail T3. The limit in this case is an N-0 overload on the Nogales-Kantor section of the line. Since the load at SIL is well above the 95 MW forecast load in this case there is no need to reconductor this line section. There is no RMR requirement in 2013.

In 2019, the SIL remains at 127 MW (load @ SIL = 120 MW) with the same limiting condition. Since SIL is above the 112 MW forecast load in this case there is no RMR requirement in 2019.

**Reliability Must-Run**

In 2010 there is a 24 MW RMR requirement to provide adequate voltage regulation at the Valencia 115 kV bus and to limit import at WAPA's Nogales 115 kV bus to </= to 65 MW. The cost to run this generation in 2010 is estimated at$550,000.

In 2013 and 2019 the SIL exceeds the forecast load so there is no RMR requirement in these years.

**Maximum Load Serving Capability ("MLSC")**

MLSC is determined with all four combustion turbines operating at maximum output, representing a 62 MW capacity at the Valencia substation.

In 2010 the MLSC for the 115 kV system is 130 MW. The limit in this case is a delta-V > 5% at the Nogales 115 kV bus for loss of the Del Bac-Nogales 115 kV line.

In 2013 and 2019 the MLSC increases to 190 MW due to the conversion to 138 kV and associated system upgrades. The limit here is an N-0 overload on the Nogales-Kantor line.

### RMR Environmental Output Estimates for 2010

All pollutants are estimated based on the 2010 generation found in this study. There was no RMR in 2013 or 2019:

**Table 2: 2010 - RMR Environmental Outputs**

| 2010 RMR Environmental Output | Estimated SO2 | Estimated NOx | Estimated PM | Estimated CO2 |
|---|---|---|---|---|
| Valencia 4 CT (lbs) | 99 | 4,887 | 1,553 | 19,522,028 |
| Valencia 1 CT (lbs) | 49 | 2,430 | 772 | 9,707,160 |

## N-1-1 and Extreme Contingencies

### N-1-1

As the UNS Electric Santa Cruz system is a radially served system, the most serious N-1-1 conditions are:

- In 2010, having one of the WAPA 115 kV ties into their Nogales Tap station out-of-service ("OOS") and subsequent loss of the other 115 kV tie, i.e. Del Bac-Nogales Tap OOS then loss of Nogales Tap-Adams, or vice-versa. This would be a load interruption scenario. Service restoration would be in accordance with the Outage Restoration Plan to include remote control startup and synchronization of the Valencia generating units, switching to serve the Kantor and Canez substations from Canoa and remote switching for service restoration to Sonoita and Valencia substations via the Valencia generators, and dispatch of TEP and UNS Electric personnel as required.
- In 2013 and 2019 the most serious contingency is either an N-1 outage of TEP's Vail T3 345/138 kV transformer or the 138 kV line segment between Vail and Kantor. This condition would require load restoration.

### Extreme Contingencies

The extreme contingency regarding the UNS Electric Santa Cruz system is loss of the radial transmission for an extended period of time.

## Conclusions

The UNS Electric transmission system in Santa Cruz County is capable of serving up to 100 MW reliably in the current 115 kV configuration that is supplied by the WAPA system at the Nogales switching station. Generation at Valencia is required when the load reaches 49 MW (or 51 MW measured at the Nogales station), with the output increased to 24 MW as the load increases to approximately 90 MW. This generation is required to provide voltage support and to limit import at WAPA's Nogales Tap 115 kV bus.

MLSC is 130 MW with all Valencia generation operating at full output; this exceeds the forecasted load by 45 MW.

Restoration of service would be required for all Santa Cruz load in the event of loss of the Nogales Switchyard to Kantor line. Partial restoration would be required for transmission line outages south of Sonoita, wherein the load served from Sonoita, Canez and Kantor would remain energized from Nogales.

The Vail to Valencia 138 kV upgrade, which is scheduled for completion in 2012, will eliminate the RMR requirement through the end of this study period.